

U.S. DEPARTMENT OF COMMERCE, PATENT AND TRADEMARK OFFICE		DATE: March 14, 2001
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		U.S. APPLICATION NO. (if known) 09/787119
INTERNATIONAL APPLICATION NO.: PCT/JP99/05001	INTERNATIONAL FILING DATE: SEPTEMBER 14, 1999	PRIORITY DATE CLAIMED: SEPTEMBER 14, 1998
TITLE OF INVENTION: TRANSFERABLE MAGNETIC TAPE, METHOD OF MANUFACTURING SAME, AND MAGNETIC CARD		
APPLICANT(S) FOR DO/EO/US: Daisuke YANO, Yoshikazu YAMAZAKI and Tessyu MIYAHARA		
Applicant hereby submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:		
<p>1. <u>XX</u> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.</p> <p>2. <u> </u> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.</p> <p>3. <u>XX</u> This express request to begin national examination procedures (35 USC 371(f)) at any time rather than delay examination until the expiration of the time limit set in 35 USC 371(b) and PCT Articles 22 and 39(1).</p> <p>4. <u>XX</u> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.</p> <p>5. <u>XX</u> A copy of the International Application as filed (35 U.S.C. 371(c)(2)):</p> <p style="margin-left: 20px;">a. <u> </u> is transmitted herewith (required only if not transmitted by the International Bureau).</p> <p style="margin-left: 20px;">b. <u>XX</u> has been transmitted by the International Bureau.</p> <p style="margin-left: 20px;">c. <u> </u> is not required, as the application was filed in the United States Receiving Office (RO/US)</p> <p>6. <u>XX</u> A translation of the International Application into English (35 U.S.C. 371(c)(2)).</p> <p>7. <u>XX</u> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))</p> <p style="margin-left: 20px;">a. <u> </u> are transmitted herewith (required only if not transmitted by the International Bureau).</p> <p style="margin-left: 20px;">b. <u> </u> have been transmitted by the International Bureau.</p> <p style="margin-left: 20px;">c. <u> </u> have not been made; however, the time limit for making such amendments has NOT expired.</p> <p style="margin-left: 20px;">d. <u>XX</u> have not been made and will not be made.</p> <p>8. <u> </u> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).</p> <p>9. <u>XX</u> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).</p> <p>10. <u>XX</u> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).</p> <p>ITEMS 11. TO 16. BELOW CONCERN OTHER DOCUMENT(S) OR INFORMATION INCLUDED:</p> <p>11. <u>XX</u> An Information Disclosure Statement under 37 CFR 1.97 and 1.98 together with the international search report and 2 references.</p> <p>12. <u>XX</u> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included. ASSIGNEE NAME AND ADDRESS: DAINIPPON INK AND CHEMICALS, INC., Tokyo, Japan</p> <p>13. <u>XX</u> A FIRST preliminary amendment. <u> </u> A SECOND or SUBSEQUENT preliminary amendment</p> <p>14. <u> </u> A substitute specification.</p> <p>15. <u> </u> A change of power of attorney and/or address letter.</p> <p>16. <u>XX</u> Other items or information: Submission of Substitute Pages; 4 sheets of drawings.</p>		

U.S. APPLICATION NO. (if known) 001/787119	INTERNATIONAL APPLICATION NO. PCT/JP99/05001	DATE: March 14, 2001																																																																																				
17. <input checked="" type="checkbox"/> The following fees are submitted:																																																																																						
Basic National Fee (37 CFR 1.492(a)(1)-(5): Search Report has been prepared by the EPO or JPO: \$860.00 International preliminary examination fee paid to USPTO (37 CFR 1.482) \$690.00 No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) \$710.00 Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$1000.00 International preliminary examination fee (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) \$100.00	CALCULATIONS	PTO USE ONLY																																																																																				
ENTER APPROPRIATE BASIC FEE AMOUNT =		\$ 860.00																																																																																				
Surcharge of \$130.00 for furnishing the oath or declaration later than __ 20 30 months from the earliest claimed priority date (37 CFR 1.492(e)).																																																																																						
<table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="width:15%;">CLAIMS</th> <th style="width:15%;">NUMBER FILED</th> <th style="width:15%;">NUMBER EXTRA</th> <th style="width:20%;">RATE</th> <th style="width:15%;"></th> <th style="width:20%;"></th> </tr> </thead> <tbody> <tr> <td>TOTAL</td> <td>29 -20 =</td> <td>9</td> <td>X \$ 18.00</td> <td>\$ 162.00</td> <td></td> </tr> <tr> <td>INDEPENDENT</td> <td>3 - 3 =</td> <td></td> <td>X \$ 80.00</td> <td></td> <td></td> </tr> <tr> <td colspan="3">Multiple dependent claims(s) (if applicable)</td> <td>+ \$270.00</td> <td>\$ 270.00</td> <td></td> </tr> <tr> <td colspan="4" style="text-align: right;">TOTAL OF ABOVE CALCULATIONS =</td> <td>\$ 1,292.00</td> <td></td> </tr> <tr> <td colspan="6" style="padding: 5px;"> Reduction by 1/2 for filing by small entity, if applicable. (Note 37 CFR 1.9, 1.27, 1.28). </td> </tr> <tr> <td colspan="4" style="text-align: right;">SUBTOTAL =</td> <td>\$ 1,292.00</td> <td></td> </tr> <tr> <td colspan="6" style="padding: 5px;"> Processing fee of \$130.00 for furnishing the English translation later than __ 20 30 months from the earliest claimed priority date (37 CFR 1.492(f)). </td> </tr> <tr> <td colspan="4" style="text-align: right;">TOTAL NATIONAL FEE =</td> <td>\$1,292.00</td> <td></td> </tr> <tr> <td colspan="4" style="padding: 5px;"> Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property + </td> <td>\$ 40.00</td> <td></td> </tr> <tr> <td colspan="4" style="text-align: right;">TOTAL FEES ENCLOSED =</td> <td>\$ 1,332.00</td> <td></td> </tr> <tr> <td colspan="4"></td> <td style="padding: 5px;"> Amount to be: </td> <td></td> </tr> <tr> <td colspan="4"></td> <td style="text-align: right; padding: 5px;"> refunded </td> <td style="text-align: center; padding: 5px;"> \$ </td> </tr> <tr> <td colspan="4"></td> <td style="text-align: right; padding: 5px;"> charged </td> <td style="text-align: center; padding: 5px;"> \$ </td> </tr> </tbody> </table>	CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE			TOTAL	29 -20 =	9	X \$ 18.00	\$ 162.00		INDEPENDENT	3 - 3 =		X \$ 80.00			Multiple dependent claims(s) (if applicable)			+ \$270.00	\$ 270.00		TOTAL OF ABOVE CALCULATIONS =				\$ 1,292.00		Reduction by 1/2 for filing by small entity, if applicable. (Note 37 CFR 1.9, 1.27, 1.28).						SUBTOTAL =				\$ 1,292.00		Processing fee of \$130.00 for furnishing the English translation later than __ 20 30 months from the earliest claimed priority date (37 CFR 1.492(f)).						TOTAL NATIONAL FEE =				\$1,292.00		Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +				\$ 40.00		TOTAL FEES ENCLOSED =				\$ 1,332.00						Amount to be:						refunded	\$					charged	\$		
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE																																																																																			
TOTAL	29 -20 =	9	X \$ 18.00	\$ 162.00																																																																																		
INDEPENDENT	3 - 3 =		X \$ 80.00																																																																																			
Multiple dependent claims(s) (if applicable)			+ \$270.00	\$ 270.00																																																																																		
TOTAL OF ABOVE CALCULATIONS =				\$ 1,292.00																																																																																		
Reduction by 1/2 for filing by small entity, if applicable. (Note 37 CFR 1.9, 1.27, 1.28).																																																																																						
SUBTOTAL =				\$ 1,292.00																																																																																		
Processing fee of \$130.00 for furnishing the English translation later than __ 20 30 months from the earliest claimed priority date (37 CFR 1.492(f)).																																																																																						
TOTAL NATIONAL FEE =				\$1,292.00																																																																																		
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +				\$ 40.00																																																																																		
TOTAL FEES ENCLOSED =				\$ 1,332.00																																																																																		
				Amount to be:																																																																																		
				refunded	\$																																																																																	
				charged	\$																																																																																	

ATTORNEY'S DOCKET NO: 010324

U.S. APPLICATION NO. (if known) 09/787119	INTERNATIONAL APPLICATION NO. PCT/JP99/05001	DATE: March 14, 2001
--	--	-----------------------------


a. ☒ A check in the amount of \$ **1,332.00** to cover the above fees is enclosed. (\$860.00 for filing fee; \$162.00 for 9 additional claims; \$270.00 for multiple dependent claims and \$40.00 for assignment recordation fee). (This paper is filed in triplicate)


b. ☐ Please charge my Deposit Account No. 01-2340 in the amount of \$___ to cover the above fees. (A duplicate copy of this sheet is enclosed.)

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 01-2340.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed to request that the application be restored to pending status.

Send All Correspondence To:


23850
PATENT TRADEMARK OFFICE


SIGNATURE
Donald W. Hanson
NAME
27,133
REGISTRATION NUMBER

DWH/yap

ARMSTRONG, WESTERMAN, HATTORI,
McLELAND & NAUGHTON, LLP
Suite 1000, 1725 K Street, N.W.
Washington, D. C. 20006
Tel: (202) 659-2930
Fax: (202) 887-0357

09/787119

JC02 Rec'd PCT/PTO 1 4 MAR 2001

PATENT
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: **Daisuke YANO et al.**

Serial Number: **Not Yet Assigned**
(PCT/JP99/05001)

Filed: **March 14, 2001**

For: **TRANSFERABLE MAGNETIC TAPE, METHOD OF MANUFACTURING
SAME, AND MAGNETIC CARD**

PRELIMINARY AMENDMENT

Director of Patents and Trademarks
Washington, D.C. 20231

March 14, 2001

Sir:

Prior to the calculation of the filing fees of the above application, please enter the substitute pages and amend the application which includes the substitute pages as follows:

IN THE CLAIMS:

Please amend claim 11 as follows:

11. (Twice amended) A method of manufacturing a transferable magnetic tape according to claim 6 or 7, wherein after said pattern printed region is formed using a printing cylinder corresponding therewith, said filling layer is formed in said filling layer region using a printing cylinder corresponding therewith, without gaps between said pattern printed region, and without overlapping.

Please add new claims 17, 18 and 19:

17. (New) A method of manufacturing a transferable magnetic tape according to claim 8, wherein after said pattern printed region is formed using a printing cylinder corresponding therewith, said filing layer is formed in said filling layer region using a printing cylinder corresponding therewith, without gaps between said pattern printed region, and without overlapping.

18. (New) A method of manufacturing a transferable magnetic tape according to claim 9, wherein after said pattern printed region is formed using a printing cylinder corresponding therewith, said filing layer is formed in said filling layer region using a printing cylinder corresponding therewith, without gaps between said pattern printed region, and without overlapping.

19. (New) A method of manufacturing a transferable magnetic tape according to claim 10, wherein after said pattern printed region is formed using a printing cylinder corresponding therewith, said filing layer is formed in said filling layer region using a printing cylinder corresponding therewith, without gaps between said pattern printed region, and without overlapping.

REMARKS

The above amendment is believed to place the claims in proper condition for examination.

Early and favorable action is awaited.

Claim 11 has been amended. New claims 17-19 have been added.

Attached hereto is a marked-up version of the changes made to the claims by the current amendment. The attached page is captioned "Version with markings to show changes made."

In the event there are any additional fees required, please charge our Deposit Account No. 01-2340.

Respectfully submitted,

ARMSTRONG, WESTERMAN, HATTORI,
McLELAND & NAUGHTON, LLP



Donald W. Hanson
Reg. No. 27,133

Atty. Docket No. 010324
Suite 1000
1725 K Street, N.W.
Washington, D.C. 20006
Tel: (202) 659-2930
DWH/yap

VERSION WITH MARKINGS TO SHOW CHANGES NAME

Claim 11 has been twice amended as follows:

11. (Twice amended) A method of manufacturing a transferable magnetic tape according to [any one of claim 6, claim 7, claim 8, claim 9 and claim 10] claim 6 or 7, wherein after said pattern printed region is formed using a printing cylinder corresponding therewith, said filing layer is formed in said filling layer region using a printing cylinder corresponding therewith, without gaps between said pattern printed region, and without overlapping.

4/PRTS

09/787119

JC02 Rec'd PCT/PTO 1 4 MAR 2001

1

DESCRIPTION

TRANSFERABLE MAGNETIC TAPE, METHOD OF MANUFACTURING SAME, AND
MAGNETIC CARD

5

TECHNICAL FIELD

The present invention relates to a transferable magnetic tape and a method of manufacturing the same as well as a magnetic card, and in particular relates to a transferable magnetic tape which incorporates a design in the magnetic stripe during the manufacture of a magnetic card, and a magnetic card where a design is incorporated in the magnetic stripe.

This application is based on Japanese Patent Application No. Hei 10-259964, the content of which is incorporated herein by reference.

BACKGROUND ART

The use of transferable magnetic tape to provide a magnetic stripe in a magnetic card during the manufacture of magnetic cards which incorporate a magnetic stripe such as credit cards, bank cards and ID cards is already widely known. Generally, transferable magnetic tape comprises a magnetic recording layer and an adhesive layer provided in sequence on a backing film. During the manufacturing process of magnetic cards, the adhesive layer of the transferable magnetic tape is superposed with the substrate of the magnetic card, heated and

20

25

pressurized, and the layer incorporating the magnetic recording layer is transferred onto the base of the magnetic card. The backing film is then removed and subsequent pressing is performed as needed, thereby embedding the magnetic recording layer into the substrate of the card, and producing the magnetic stripe.

Consequently, it is unavoidable that the color of the magnetic recording layer shows on the surface of the magnetic card in the magnetic stripe region, and generally a stripe which is brown or black appears on the surface of the card, placing limitations on the design of the card.

In order to solve this limitation, a transferable magnetic tape has been proposed where a colored layer is provided between the backing film and the magnetic recording layer. However in this case, the entire magnetic stripe simply changes to another color, and limitations still remain in the design of cards.

FIG. 1 shows a cross-section of a transferable magnetic tape according to a first conventional technology. The first conventional technology proposes a transferable magnetic tape where a printed layer is provided between a backing film 1 and a magnetic recording layer 2. An adhesive layer 4 is provided on the magnetic recording layer 2 on the opposite surface to the backing film 1. In the case of single color printing when only one type of a printing ink 3 is used, the printed layer is provided by placing the printing ink 3 partially onto the backing film 1, and if a magnetic card is made with this type

of transferable magnetic tape, then design can be freely performed on the magnetic stripe, and the degree of freedom in the design of magnetic cards increases. However, with a magnetic card made with this type of transferable magnetic tape, a problem occurs in that the magnetic recording and read-back characteristics are reduced by the printing ink 3 or the like.

In the case where a magnetic card is manufactured by opposing and superposing an adhesive layer 4 of a transferable magnetic tape where this type of printed layer is provided, and a base material 5 of the magnetic card, and then removing the backing film 1, the printed layer ends up closer to the surface layer of the magnetic card than the magnetic recording layer 2, as shown in FIG. 2. In the case of single color printing where only one type of the printing ink 3 or the like is used, the printed layer comprises a pattern printed region 6 which corresponds with the patterned section, and another non-printed region 7. In the pattern printed region 6, the section of the printing ink 3 which corresponds with the pattern printed region 6 formed by the printing ink, partially covers the surface of the magnetic card, whereas in the non-printed region 7, there is no printing ink 3 section above the magnetic recording layer 2, and the magnetic recording layer 2 is exposed on the surface of the magnetic card.

Normally, the recording and reading of magnetic data is performed by a magnetic head contacting the magnetic stripe of the magnetic card and then moving relative to the stripe. At

this time, if the aforementioned printed layer exists, then in the pattern printed region 6, the magnetic head faces the magnetic recording layer 2 through the printing ink 3 section, and a distance develops between the magnetic head and the magnetic recording layer 2. If in this manner, distance develops between the magnetic head and the magnetic recording layer 2, the read-back output reduces, and so called spacing loss occurs.

In contrast, in the non-printed region 7, the magnetic recording layer 2 and the magnetic head are directly facing one another, and spacing loss does not occur. As a result, there is a difference in the read-back output between the pattern printed region 6 where this spacing loss occurs and the non-printed region 7 where spacing loss does not occur, and so variation occurs in the output. Variation in the read-back output is a cause of errors when recording to and reading from magnetic cards, and practical application of a magnetic card which has a large output variation is impossible.

A similar problem is that when the printed layer is printed using multiple colors for example, even in those cases when all of the magnetic recording layer 2 is covered with printing ink 3 of one color or another, if the printing thickness of each color of ink is not specially controlled, then because the degree of spacing loss differs for each color, the problem of output variation occurs in the same manner.

In other words, when the printed layer is formed using

multicolor printing, usually a plurality of the printing inks 3 or the like are placed on the backing 1 so that they do not overlap, or that a portion of the printing inks 3 or the like do overlap. Even in the case where the plurality of printing inks 3 are placed so as not to overlap, because each of the printing inks 3 is placed with the reproducibility of the color development as the highest priority, no particular attention is paid to the printing thickness, and it is normal for there to be differences in the printing thickness of each of the plurality of printing inks 3 or the like. As a result, in magnetic cards made using a transferable magnetic tape having a printed layer formed by such multicolor printing, the spacing loss varies for each of the printing inks 3, and variation occurs in the output. Furthermore, when the plurality of printing inks 3 or the like are placed so as to overlap each other, because there is an extremely large difference in spacing loss between the sections where the printing inks are made to overlap and the sections where the printing inks do not overlap, the problems mentioned above occur even more markedly.

In order to improve this kind of output variation, it is necessary to make the printed layer as thin as possible, and keep the size of the spacing loss of the pattern printed region 6 itself, or the range of variation in the spacing loss as small as possible. However if the thickness of the printed layer is reduced, the color of the pattern printed region 6 will be strongly influenced by the color of the magnetic

recording layer 2 positioned therebelow, and a problem arises in that the colorization is reduced markedly. As a result, there is a limit to attempting to reduce the spacing loss by making the printed layer thinner, and it is impossible to completely prevent output variation.

Furthermore, according to a second conventional technology, studies are being conducted to improve the contrast between the pattern printing and the background by providing a colored layer and a masking layer between the printed layer and the magnetic recording layer. In such a case, in the pattern printed region, the magnetic recording layer faces the magnetic head through the printing ink section, the colored layer and the masking layer, whereas in the non-printed region, the magnetic recording layer faces the magnetic head through only the colored layer and the masking layer. As a result, the distance between the magnetic head and the magnetic recording layer, in other words the spacing loss, varies, and variation still occurs in the output.

Furthermore, in contrast, in the aforementioned configuration, a method could be proposed where after the printed layer is provided on the backing film, the colored layer is formed using a leveling coating method such as a knife coating method so as to make the surface of the colored layer smooth, before the masking layer and magnetic recording layer are subsequently applied.

However with this method, because the colored layer is finished smoothly while still wet, when this colored layer

subsequently dries and solidifies, volumetric shrinkage occurs, and it is unavoidable that a roughness corresponding with the printing ink section remains on the surface. As a result, even with this method, variation in spacing loss and
5 variation in the output cannot be completely suppressed.

Furthermore, because the colored layer is provided to completely cover the printing ink section, it is unavoidable that the colored layer exist between the printing ink section and the masking layer. Not only does the colored layer in
10 this section not contribute anything to the design of the magnetic card, but when made into a card, the distance between the magnetic head and the magnetic recording layer increases, causing an increase in spacing loss. An increase in spacing loss causes a decrease in the magnetic recording and read-back
15 abilities, especially a decrease in the resolution, and has a large influence on the characteristics of the magnetic card.

As a result, in the case where the colored layer is applied so that the thickness of the colored layer which exists between the printing ink section and the masking layer
20 is reduced, then in the printed layer the area of the pattern printed region is generally comparatively smaller than that of the non-printed region. Therefore, when the wet colored layer is scraped with a knife, the colored layer of the non-patterned section, which is essential, may be excessively
25 scraped, and creating a problem in that the surface is not smooth.

In order to prevent the aforementioned defect, it is

necessary to apply the colored layer thickly. In such a case, the spacing loss increases with the existence of the masking layer, and a reduction in the magnetic recording and read-back capabilities is unavoidable.

5 According to the conventional technology described above, in a transferable magnetic tape having a printed layer, the printed layer is formed by partially placing a printing ink 3 or the like onto a backing film 1. At this time, the printed layer comprises a pattern printed region 6 where the printing ink 3 has been placed and a non-printed region 7 where the printing ink 3 has not been placed, and after the printed layer is formed, the pattern printed region 6 exists on the backing film 1 as a series of protrusions and depressions corresponding with the pattern, and the surface is uneven.

10 The surface unevenness caused by this kind of printing does not disappear, even when, as described above, multicolor printing is used and the printing ink 3 or the like is placed so as to cover the entire surface of the backing 1, for as long as no particular attention is paid to adjusting the printing thickness, there will usually be a difference in the printing thickness between the different printing inks 3.

15 In the first conventional technology, the magnetic recording layer 2 is obtained by applying a magnetic recording layer coating solution onto this uneven printed layer having only the pattern printed region 6. However at this time, if a contour coating method such as a reverse-roll coating method is used, the magnetic recording layer coating solution will be

20

25

applied at an even thickness, filling in those sections other than the protrusions from the pattern printed region 6, in other words the depressions representing the non-printed region 7 where the printing ink 3 or the like has not been placed. In other words, the boundary surface of the magnetic recording layer 2 above the pattern printed region 6 shows a series of steps displaced perpendicularly above the printing ink 3 sections (protrusions) of the printed layer and the depressions of the non-printed region 7. A typical cross section of this type of transferable magnetic tape is shown in FIG. 3.

In the case where a magnetic card is made using transferable magnetic tape formed in this manner and magnetic recording and read-back is performed, then in the pattern printed region, the magnetic recording layer faces the magnetic head through the printing ink section, and the read-back output is degraded due to spacing loss. In contrast, in the non-printed region, the magnetic recording layer faces the magnetic head directly, and so spacing loss is non-existent and degradation is not seen in the read-back output. Because sections where the read-back output is degraded, and sections where the read-back output is not degraded will pass the magnetic head in sequence in this manner, output variation occurs.

Furthermore, when the magnetic recording layer coating solution is applied onto the printed layer, in the case where a leveling coating method such as a knife coating method is

used, the magnetic recording layer coating solution will fill in the sections around the protrusions of the printing ink sections, in other words the depressions of the non-printed region where no printing ink exists. Consequently, the

5 boundary surface of the provided magnetic recording layer on the side of the pattern printed region will show a series of steps reflecting the printing ink sections (protrusions) and the non-printed sections (depressions) of the pattern printed layer.

10 Furthermore, because the boundary face of the magnetic recording layer on the pattern printed region side displays these steps, whereas the other side is smooth, unevenness appears in the thickness of this magnetic recording layer. A typical cross section of this type of transferable magnetic
15 tape is shown in FIG. 1, and a cross section of a magnetic card made using this transferable magnetic tape is shown in FIG. 2. In a magnetic recording medium on a card, the difference in the thickness of the magnetic recording layer is in proportion to the size of the read-back output, and in the
20 case of the magnetic card shown in FIG. 2, in addition to the occurrence of spacing loss due to the presence of the printing ink 3, variations in output occur as a result of the difference in the thickness of the magnetic recording layer 2, making the output variation of the magnetic card even worse.

25 Consequently, even when the printed layer is provided between the backing film and the magnetic recording layer, in order to achieve a transferable magnetic tape where output

variation does not occur when made into a card, it is essential that the thickness of the magnetic recording layer is uniform and that output variation caused by a difference in the thickness does not occur, and moreover that when made into a card, the distance between the surface of the card and the magnetic recording layer is constant. In other words, the size of the spacing loss must not vary.

The cause of the variation in the spacing loss is that, as described above, the magnetic recording layer is influenced by the protrusions which form the pattern printed region of the printed layer, and the depressions which form the non-printed region, and differences in level occur in the boundary surface on the pattern printed region side of the magnetic recording layer. Consequently, in order to keep the size of this spacing loss constant, the magnetic recording layer should not be influenced by the unevenness resulting from the printing ink sections and the non-printed region of the printed layer which is provided as the lower layer. In other words, it is essential that there be no differences in level on the boundary surface of the magnetic recording layer closer to the pattern printed region side.

This type of magnetic recording layer, where the thickness is constant and in which there are no differences in level, is achieved by applying the coating solution for the magnetic recording layer onto a smooth surface, regardless of whether a contour coating method or a smooth coating method is used. Consequently, in a transferable magnetic tape having a

printed layer provided between the backing film and the magnetic recording layer, it is necessary that there be no unevenness in the surface of the printed layer following formation of the layer with printing ink.

5

DISCLOSURE OF INVENTION

An object of the present invention is to provide a transferable magnetic tape where a design can be incorporated on the magnetic stripe when producing a card, and a magnetic card where a design has been incorporated in the magnetic stripe, and in particular to provide a magnetic card and a transferable magnetic tape where the occurrence of output variation can be suppressed even in the case where a printed layer is provided.

10

15

20

Specifically, the foremost issue which could not be solved by either the aforementioned first conventional technology or the second conventional technology, is to provide a transferable magnetic tape which enables production of a magnetic card which, regardless of the design to be applied, suffers no variation in the output, and moreover has sufficient resolution and is therefore resistant to errors during recording and reading.

25

As a result of thorough investigation of transferable magnetic tapes which can enable production of a magnetic card where, as described above, the magnetic properties do not change regardless of what type of design is applied as the printed layer, the inventors discovered that the largest

contributing factor to output variation in the case where the magnetic recording layer is uniform, is a printed layer in which the printed thickness is not uniform, and that by forming the printed layer from a pattern printed region and a remaining region made up of a filling layer, and printing these two regions without gaps therebetween so that the printing thickness is uniform, the output variation of the magnetic recording layer can be suppressed regardless of what kind of design is applied. Moreover they discovered that by printing each color of the printing ink or the like in such a manner that the inks do not overlap, the extra ink required for the image of the second printing ink to duplicate and cover the image part of the first printing ink becomes unnecessary and spacing loss is reduced, and as a result, sufficient resolution can be achieved.

The inventors, as a result of thoroughly investigating the layer compositions of the printed layer and the magnetic recording layer required in order to achieve the above object, found that the main reasons for the occurrence of output variation are linked to differences in level in both the boundary surface of the magnetic recording layer closer to the pattern printed region, and the thickness of the magnetic recording layer. In other words, the surface that faces and contacts the magnetic head should be uniformly smooth, and moreover, the distance between this surface and the magnetic recording layer should be constant for all sections, and the region comprising the pattern printed region and the filling

layer should not overlap. The inventors found that the above object can be achieved when the thickness of the magnetic recording layer is even, and there are no differences in level in the boundary surface of the magnetic recording layer closer to the pattern printed region.

The present invention was conceived with a view to achieving the above object, and provides a transferable magnetic tape in which a printed layer, a magnetic recording layer, and an adhesive layer are layered in sequence upon a backing film, with the printed layer closest to the backing film, wherein the printed layer comprises:

- (1) a pattern printed region and,
- (2) a region consisting of a filling layer outside the pattern printed region (1), and moreover
- (3) the thickness of the printed layer is substantially uniform.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross section diagram of a conventional transferable magnetic tape in which a printed layer is provided on a backing film, and a magnetic recording layer coating solution is then applied thereon using a smooth coating method to produce a magnetic recording layer.

FIG. 2 is a cross section diagram of a conventional magnetic card manufactured using a transferable magnetic tape in which a printed layer is provided on a backing film, and a magnetic recording layer coating solution is then applied

thereon using a smooth coating method to produce a magnetic recording layer.

FIG. 3 is a cross section diagram of a conventional transferable magnetic tape in which a printed layer is provided on a backing film and a magnetic recording layer coating solution is then applied thereon using a contour coating method to produce a magnetic recording layer.

FIG. 4 is a cross section diagram of a magnetic card manufactured using a transferable magnetic tape according to the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

In the present invention, the region which is printed at first is called a pattern printed region (a pattern printed region (1)). Subsequent to the formation of the pattern printed region, secondly a non-printed region, which is the area not covered by the pattern printed region, is filled, forming a region made up of this filling layer (a filling layer region (2)). The printed layer comprising these two regions, the region (1) and the region (2), is produced so that the thickness thereof is substantially uniform. As a result, the thickness of the printed layer becomes substantially uniform. It is necessary that the region (1) and the region (2) are different, and the point of difference is typically the color. As a result, a typical printed layer is printed using multicolor printing.

This type of transferable magnetic tape is obtained by

forming the pattern printed region (1) upon a backing film, subsequently forming the filling layer region (2) in the non-printed region not covered by the pattern printed region (1) and forming the printed layer comprising these two regions so that the thickness thereof is uniform, and then sequentially layering a magnetic recording layer and an adhesive layer thereon.

Moreover, publicly known conventional methods can be employed in forming the pattern printed region (1) and the filling layer region (2), although all such methods can use printing ink or the like.

The printing inks or the like used in the present invention are non-magnetic, and the printing inks or the like of the present invention include not only printing inks in the narrow sense comprising a binder resin and a colorant as the essential ingredients, but also at least printing inks comprising only a binder resin. In the present invention, when referring to a printing ink, unless stated otherwise, the above definition of printing ink (printing ink in the broad sense) applies. According to this definition, of the printing inks or the like which comprise the pattern printed region (1) and the filling layer region (2), there are cases where one of the two is a printing ink colored with pigment and the other is a clear printing ink, and there are also cases where both are printing inks of different colors which are colored by different pigments. In brief, the printing ink used in the pattern printed region (1) and that used in the filling layer

region (2) should be different.

This type of printed layer which is free of surface irregularities, cannot be considered with conventional multicolor printing. It can only be achieved where, for example, pattern printing is performed on a backing film using a printing ink (a first printing ink No. 1) with the pattern printed region (1) being formed by partial placement of this printing ink, and subsequently, the non-printed region where the printing ink (the first printing ink) has not been placed is filled with a printing ink different from that used in the pattern printed region (a printing ink No. 2) and adjusted so that the thickness is the same as the pattern printed region (1), thereby creating the second region (the filling layer region (2)).

Furthermore, the object can also be achieved by in an opposite manner to that described above, by using the second printing ink used to cover the second region (the non-printed region) and firstly providing a printing ink section where the second printing ink is partially placed on the backing film (this second region corresponds with the filling layer region (2)), and subsequently filling the gap sections where the second printing ink has not been placed using the first printing ink, in a manner so that the thickness is the same as that of the sections of the second printing ink, thereby providing the first printing ink section (corresponding with the pattern printed region (1)).

In other words, after the pattern printed region is

formed using the printing cylinder corresponding therewith,
the region comprising the filling layer can be formed using
the printing cylinder corresponding with the non-printed
region. With printing plates, this is attainable by preparing
5 both a positive plate and a negative plate for the same image
and using both of these.

Providing a pattern printed region (1) and a filling
layer region (2) of equivalent thickness is achieved by, for
example, forming the printing inks used when forming the two
10 regions from ingredients for which the color differs but for
which the volumetric shrinkage rate which accompanies the
drying and solidification thereof is equivalent.

Furthermore, even in the case where the volumetric
shrinkage rate of each ink differs, it is possible to make the
15 thickness after drying and solidification equivalent by
changing the quantity of each of the printing inks with
consideration to these differences.

Furthermore the aforementioned second region (the filling
layer region (2)) need not necessarily be composed of only one
20 type of printing ink or the like, and may be composed of two
or more regions of different types of printing ink or the
like. This is also true for the first region (the pattern
printed region (1)).

Even when the first region is formed using two or more
25 different printing inks or the like, and even when the second
region is formed using two or more different printing inks or
the like, printing is still performed so that the thickness of

each of the printing inks is identical, and so that each of the printing inks do not overlap, thereby ensuring that the thickness is identical.

The above describes a situation where the printed layer, comprising the region (1) and the region (2), is provided directly onto the backing film.

FIG. 4 shows a cross section diagram of a magnetic card obtained by the methods set forth in the present invention. In the figure, numeral 2 shows a magnetic recording layer, numeral 3 a first printing ink, numeral 4 an adhesive layer, numeral 5 a card base material, numeral 6 a pattern printed region (a first region), numeral 8 a second printing ink which is different from the first printing ink, and numeral 9 a filling layer region (a second region excluding the pattern printed region).

When the magnetic recording layer is provided on a printed layer which is provided in this manner, the magnetic recording layer is not influenced by unevenness of the lower printed layer, and there are no differences in level in the boundary surface of the magnetic recording layer closer to the pattern printed region, and it becomes possible to produce a magnetic recording layer of a uniform thickness, which when made into a card will not suffer from output variation.

In the present invention, any of the conventionally used materials can be used as the backing film. This backing film is peeled away at the point where this magnetic card is manufactured, as described below. Examples of suitable

backing film materials include polyesters such as polyethylene terephthalate and polyethylene-2,6-naphthalate, polyolefins such as polypropylene, cellulose derivatives such as cellulose triacetate and cellulose diacetate, and plastics such as polyamides and polycarbonates. Among these materials, polyethylene terephthalate, which combines good tensile strength and heat resistance, is preferable.

There is no particular limit on the thickness of the backing film, although typical values are 3 to 100 μm , with thickness values of 5 to 50 μm being preferable.

In the present invention, a protective layer having peelability from the backing film may be provided between the backing film and the printed layer. In such a case, the aforementioned printed layer is formed on top of this protective layer after the protective layer has been provided on the backing film.

The protective layer used in the present invention is removed from the backing film together with the other layers by transfer, and as the outermost layer of all the transferred layers, also has a surface protection function. Examples of suitable materials for the protective layer include cellulose based resins, polyvinyl butyral resin, epoxy resins, phenolic resins, polyester resins, polyurethane resins, acrylic resins, polymethyl methacrylate and copolymers thereof, melamine resin and mixtures of these resins.

In addition, soybean lecithin, phthalic acid based

plasticizers, microsilica or waxes or the like can be added to the protective layer as a coating modifying agent according to need.

The protective layer is formed, for example, by applying
5 a coating produced by dissolving and dispersing the
aforementioned constituents in a solvent, using conventional methods.

The thickness of the protective layer is 0.5 to 5 μm , and preferably 0.5 to 2 μm .

10 In the present invention, when a magnetic card is
manufactured using a transferable magnetic tape of the present
invention, the printed layer is provided so that the desired
design can be applied to the magnetic stripe portion of the
magnetic card.

15 In the present invention, it is vital that the thickness
of the magnetic recording layer provided upon the printed
layer is uniform and also that there are no differences in
level in the boundary surface of the magnetic recording layer
closer to the pattern printed region. This kind of magnetic
20 recording layer can be attained by forming the printed layer
from a printing ink section which corresponds with the design
and a section of at least one other type of printing ink, and
by ensuring that the thickness of these sections is uniform.
In other words, it is necessary that the printed layer is
25 formed of at least two or more sections of an equal thickness.

The printing ink section which forms the pattern printed
region is formed by printing a printing ink containing, for

example, a pigment, a dye, a resin binder and a solvent for dissolving the resin binder onto either the backing film or a protective layer which has been provided on the backing film.

Suitable examples of the pigment used in the printing ink or the like include; inorganic pigments such as alumina, titanium oxide, chrome oxide, iron oxide, zinc oxide and barium sulfate, and organic pigments such as azo based pigments, phthalocyanine based pigments, quinacridone based pigments, perylene based pigments, anthraquinone based pigments, thioindigo based pigments and indanthrene based pigments, but there are no particular restrictions on the pigments which can be used. The printing ink is made by blending either a single type or two or more types of pigment with the binder resin and dispersing the mixture using conventional methods.

Furthermore, in place of or used jointly with the aforementioned pigment, dyes such as phthalocyanine dyes, azo dyes, nitro dyes, quinoline dyes, methine dyes, azine dyes and phthalein dyes can be used.

Suitable materials for the binder resin and the solvent include those materials detailed below.

Conventional binder resins can be used as the binder resin. Suitable examples include butyral resin, vinyl chloride-vinyl ether copolymer resins, urethane resins, polyester resins, cellulose based resins, acrylic resins, and styrene-maleic acid copolymer resins, and rubber resins such as nitrile rubber or urethane elastomer can be added to these

resins according to need. Furthermore, heat curing can also be performed using an isocyanate compound.

Suitable solvents include, for example, ketone based solvents such as acetone, methyl ethyl ketone (MEK), methyl isobutyl ketone (MIBK) and cyclohexanone, ester based solvents such as methyl acetate, ethyl acetate and butyl acetate, alcohol based solvents such as methanol, ethanol and propanol, hydrocarbons such as hexane, benzene, toluene and xylene, and ether based solvents such as glycol dimethyl ether, glycol monoethyl ether, dioxane and tetrahydrofuran, and these solvents can also be used as mixtures of two or more solvents.

Furthermore, for the materials which form the printing ink sections of the pattern printed region, by using materials which absorb or reflect light of a specific wavelength, materials which emit fluorescence or phosphorescence, materials which retain light, or other materials which can be detected by a specific method, be it visible or invisible, tamper proof and forgery proof properties can be added. These materials can also be used to form the filling layer region.

In the forming of the printing ink section of the first region, conventional printing methods such as gravure printing, flexographic printing, offset printing and screen printing can be used, although from the viewpoint of print quality and productivity, gravure printing is particularly well suited.

The printing ink used to fill the second region (the non-printed region) is obtained by filling the second region so

that the thickness of the second printing ink following drying is the same as the thickness of the first region (the pattern printed region).

A printing ink which differs from the first printing ink can be used as the printing ink for filling the second region (the non-printed region) in the same manner as the first printing ink, and for example, the aforementioned binder resin solution containing the binder resin and the solvent to dissolve the binder resin can be used, and pigment and dye can be added to the aforementioned binder resin solution according to need. When the sections other than the first region are printed using the second printing ink which is of a different color to the first printing ink, the non-printed region also becomes colored, further improving the ability to incorporate designs on the magnetic card.

Furthermore, the printing ink used for forming the first region and the printing ink used for forming the second region may also be a resin having UV curing, EB curing, or electron beam curing properties. Furthermore, thermoplastic resins can also be used following heating and melting.

The important factors when choosing a printing ink, for both the first printing ink and the second printing ink, are that the materials have no magnetic properties, that the thickness after drying and hardening is controllable, and that each printing ink section can be provided at the same thickness. Furthermore, the printing ink which forms the first region and the printing ink which forms the second

region must be different.

When producing the printing ink for forming the second region, conventional pigments and dyes can be added to the aforementioned resin binder solution, in the same manner as the printing ink for forming the first region. In such cases, the second region (the non-printed region) also becomes colored, and the ability to incorporate designs on the magnetic card is further improved.

Furthermore, by including in the printing ink for forming the second region, materials which absorb or reflect light of a specific wavelength, materials which emit fluorescence or phosphorescence, materials which retain light, or other materials which can be detected by a specific method, be it visible or invisible, tamper proof and forgery proof properties can be added.

Moreover, instead of composing the second region of a single printing ink, a plurality of printing inks can also be used, creating two or more regions.

Any conventional printing method or coating method can be used for filling the second region, but using a printing method, and particularly a gravure printing method, is preferable from the viewpoint of productivity and simplicity.

Furthermore, the printed layer can also be obtained by firstly forming the second region (the section corresponding with the non-printed region) by a conventional printing method, and then filling in the gaps therein with the printing ink for forming the aforementioned first region (the pattern

printed region).

In such cases, any conventional printing method or coating method can be used as the filling method, but using a printing method is preferable, particularly a gravure printing method.

The pattern printed region and the filling layer region which make up the printed layer must be provided so that the thickness after drying and solidification is the same for both regions, and a thickness of 0.5 to 5 μm is desirable, with values of 0.5 to 2 μm being particularly desirable from the perspective of spacing loss.

In the present invention, magnetic powder and binder resin are the essential ingredients of the magnetic recording layer.

The magnetic recording layer is formed by applying a magnetic paint containing, for example, a magnetic powder, a resin binder and a solvent for dissolving the resin binder, onto the backing film where the printed layer has been formed, and subsequently drying the magnetic paint.

The thickness of the magnetic recording layer is preferably within the range of 2 to 100 μm , with values of 5 to 20 μm being even more desirable.

Suitable magnetic powders which can be used include conventional magnetic powders such as γ -ferric oxide, magnetic iron ore, cobalt gamma ferric oxide, chromium dioxide, iron based metallic magnetic powders, barium ferrite and strontium

ferrite. For the magnetic powder, a coercivity in the range of 20 to 320 kA/m is preferable.

Commonly used binder resins can be used as the binder resin. Suitable examples include butyral resin, vinyl
5 chloride-vinyl ether copolymer resins, urethane resins, polyester resins, cellulose based resins, acrylic resins, and styrene-maleic acid copolymer resins, and rubber resins such as nitrile rubber or urethane elastomer can be added to these resins according to need. Furthermore, heat curing can also
10 be performed using an isocyanate compound.

Suitable solvents include, for example, ketone based solvents such as acetone, methyl ethyl ketone (MEK), methyl isobutyl ketone (MIBK) and cyclohexanone, ester based solvents such as methyl acetate, ethyl acetate and butyl acetate,
15 alcohol based solvents such as methanol, ethanol and propanol, hydrocarbons such as hexane, benzene, toluene and xylene, and ether based solvents such as glycol dimethyl ether, glycol monoethyl ether, dioxane and tetrahydrofuran, and these solvents can also be used as mixtures of two or more solvents.

20 The magnetic paint is obtained by mixing and dispersing, for example, the aforementioned magnetic powder, a resin binder and a solvent.

Furthermore, auxiliaries such as surface active agents, silane coupling agents, plasticizers, wax and silicone oil may
25 be added to the dispersed material resulting from the dispersion of the magnetic powder in the aforementioned resin, and carbon black and other fillers can also be added.

Various mixing and dispersion devices can be used for the mixing and dispersion required to make the magnetic paint.

Suitable examples of mixing and dispersion devices include a two roll mill, a three roll mill, a ball mill, a pebble mill, a Henschel mixer, a cobble mill, a thoron mill, a sand mill, a sand grinder, a segubariatoraita, a high speed impeller disperser, a high speed stone mill, a high speed impact mill, a Disper, a high speed mixer, a homogenizer, an ultrasound disperser, an open kneader, a continuous kneader and a pressurized kneader.

Moreover a masking layer may also be formed between the printed layer and the magnetic recording layer. The masking layer masks the color of the magnetic recording layer, and is placed between the magnetic recording layer and the printed layer in order to enhance the coloring of the printed layer. This masking layer can be obtained by, for example, mixing and dispersing in a resin binder, metal powders such as aluminum, copper, and silver, or pigments such as titanium oxide, zinc oxide and silica, and then applying the masking layer coating to the printed layer using a conventional method and subsequently drying the layer. The masking layer can also be colored by adding conventional pigments and dyes.

Furthermore, a metal evaporated layer can also be used as the masking layer, and in such a case, a metal evaporated layer can be formed by producing the layer from metals such as aluminum and tin using a method such as vacuum deposition or sputtering. The masking layer may also comprise a plurality

of layers.

Of course, a protective layer having peelability from the backing film can also be provided between the backing film and the printed layer as well as a masking layer being provided
5 between the printed layer and the magnetic recording layer.

In the case where a coating method is used to provide the masking layer, a thickness of 0.5 to 5 μm is preferable, whereas in the case where a metal evaporated layer is used as the masking layer, a thickness of 0.05 to 0.5 μm is
10 preferable.

In a transferable magnetic tape, the combined thickness of the protective layer, the printed layer and the masking layer which exist between the backing film and the magnetic recording layer should be made as small as possible, and from
15 the perspective of magnetic recording and read-back characteristics when made into a card, a total of no more than 10 μm is preferable, with values of less than 6 μm being particularly desirable.

The adhesive layer used in the present invention is
20 generally obtained by dissolving a resin which displays thermal adhesiveness properties in a solvent, adjusting the adhesive coating by mixing and agitation, and then applying this adhesive coating onto the magnetic recording layer using conventional methods and subsequent drying of the layer.

25 Examples of resins which show properties of thermal adhesiveness include, for example, vinyl chloride based resins

such as copolymers of vinyl chloride and vinyl acetate, or copolymers which also incorporate vinyl alcohol, maleic anhydride or acrylic acid, as well as polyester resins, acrylic resins, polyimide resins and polyurethane resins.

5 The thickness of the adhesive layer should preferably be 0.5 to 15 μm , with values of 0.5 to 5 μm being particularly desirable.

10 The main points of the present invention are that the thickness of the magnetic recording layer provided on the printed layer is uniform, and that there are no differences in level in the boundary surface of the magnetic recording layer closer to the pattern printed region. Other than the points described above, there are no limitations on the methods for forming the printed layer or the methods for forming the
15 magnetic recording layer.

20 Examples of materials which can be used as the substrate (the card base material) of the magnetic card on which the transferable magnetic tape according to the present invention is used include plastic film or sheet made of polyvinyl chloride, nylon, cellulose diacetate, polystyrene, polyethylene, polypropylene, polyester, polyimide or polycarbonate, metals such as copper or aluminum, paper, impregnated paper, cloth paper, or a complex comprising any of
25 materials different from those listed above, provided they have sufficient strength to be used as a magnetic recording medium.

A magnetic card according to the present invention is a magnetic card in which a magnetic recording layer and a printed layer are formed in sequence on a card base material with the magnetic recording layer closer to the base material,

5 wherein the printed layer comprises:

(1) a pattern printed region and,

(2) a region consisting of a filling layer outside the pattern printed region (1), and moreover

10 (3) the thickness of the printed layer is substantially uniform.

The magnetic card is usually manufactured from a transferable magnetic tape according to the present invention.

15 A magnetic card according to the present invention can be obtained by using a transferable magnetic tape of the present invention, superposing the adhesive layer of the tape with the card base material, adhering the two together, and then peeling off the backing film of the transferable magnetic tape to achieve the transfer. Alternatively, the magnetic card can also be obtained by first peeling the backing film off the
20 transferable magnetic tape of the present invention, then superposing the adhesive layer with the card base material and then adhering the two together. Furthermore, if needed, the adhesive layer of the transferable magnetic tape can be adhered to a portion of the card base material and the
25 outermost layer of the magnetic tape then embedded so to be flush with the surface of the card base material.

A magnetic card according to the present invention can

also be obtained by using a transferable magnetic tape of the present invention, transferring one side of the magnetic recording layer onto a transparent vinyl chloride oversheet, subsequently sandwiching an opaque vinyl chloride inner core which functions as the substrate of the magnetic card between the oversheet to which the magnetic recording layer was transferred and one other transparent vinyl chloride oversheet, and then performing thermocompression before punching the medium out into a card shape. However, magnetic cards of the present invention are not limited to this construction. For example, a transferable magnetic tape of the present invention could simply be used as the aforementioned magnetic card substrate, and the layers, including the magnetic recording layer, then transferred directly thereon.

Embodiments of the Invention

1. A transferable magnetic tape in which a printed layer, a magnetic recording layer, and an adhesive layer are layered in sequence upon a backing film, with the printed layer closest to the backing film, wherein the printed layer comprises:

- (1) a pattern printed region and,
- (2) a region consisting of a filling layer outside the pattern printed region (1), and moreover
- (3) the thickness of the printed layer is substantially uniform.

2. A transferable magnetic tape according to the first

aspect of the present invention described above, wherein the filling layer comprises a printing ink.

3. A transferable magnetic tape according to either one of the first aspect and the second aspect of the present

5 invention, wherein a protective layer is provided between the backing film and the printed layer.

4. A transferable magnetic tape according to either one of the first aspect and the second aspect of the present

10 invention, wherein a masking layer is provided between the printed layer and the magnetic recording layer.

5. A transferable magnetic tape according to either one of the first aspect and the second aspect of the present

invention, wherein a protective layer is provided between the backing film and the printed layer, and a masking layer is

15 provided between the printed layer and the magnetic recording layer.

6. A method of manufacturing a transferable magnetic tape wherein a pattern printed region is formed on a backing film,

20 a filling layer is subsequently formed in a non-printed region and a printed layer comprising the printed region and the non-

printed region is formed so as to have a uniform thickness, and a magnetic recording layer and an adhesive layer are then sequentially layered thereon.

7. A method of manufacturing a transferable magnetic tape according to the sixth aspect of the present invention

25 described above, wherein the filling layer comprises a printing ink.

8. A method of manufacturing a transferable magnetic tape according to the sixth aspect of the present invention described above, wherein the pattern printed region is formed after the protective layer is formed upon the backing film.

5 9. A method of manufacturing a transferable magnetic tape according to the sixth aspect of the present invention described above, wherein a masking layer is provided between the printed layer and the magnetic recording layer.

10 10. A method of manufacturing a transferable magnetic tape according to the sixth aspect of the present invention described above, wherein a protective layer is provided between the backing film and the printed layer, and a masking layer is provided between the printed layer and the magnetic recording layer.

15 11. A method of manufacturing a transferable magnetic tape according to the seventh aspect of the present invention described above, wherein after the pattern printed region is formed using a printing cylinder corresponding therewith, the filling layer is formed using a printing cylinder
20 corresponding with the non-printed region.

12. A magnetic card in which a magnetic recording layer and a printed layer are formed in sequence on a card base material with the magnetic recording layer closer to the base material, wherein the printed layer comprises:

25 (1) a pattern printed region and,

(2) a region consisting of a filling layer outside the pattern printed region (1), and moreover

(3) the thickness of the printed layer is substantially uniform.

13. A magnetic card according to the twelfth aspect of the present invention described above, comprising an adhesive layer on the card base material.

14. A magnetic card according to the twelfth aspect of the present invention described above, comprising a protective layer on top of the printed layer.

15. A magnetic card according to the twelfth aspect of the present invention described above, comprising a masking layer between the printed layer and the magnetic recording layer.

16. A magnetic card according to the twelfth aspect of the present invention described above, comprising a protective layer on the printed layer and a masking layer between the printed layer and the magnetic recording layer.

Examples

The present invention will be described in greater detail below using working examples and comparative examples.

However, the present invention is not limited to these examples. The term "parts" below refers to units of mass.

Example 1

Using a polyethylene terephthalate film with a thickness of 24 μm as a backing film, a composition as described below was applied to one side of the film using a reverse coating method to provide a protective layer which, following drying,

had a thickness of 1 μm . Subsequently, using a composition b described below, a printing ink was applied by gravure printing in a pattern corresponding with the pattern of a printed layer, so that the thickness following drying was

5 1.5 μm (the pattern printed region (1)), and following drying, a gravure plate which is the negative pattern of the aforementioned pattern, was used to perform gravure printing with a composition c described below to produce a thickness after drying of 1.5 μm (the filling layer region (2)). A
 10 magnetic recording layer was then applied using a composition d described below, using a reverse coating method, to produce a thickness following drying of 7 μm , and subsequently, a reverse coating method was used to provide an adhesive layer of a composition e described below, yielding a thickness
 15 following drying of 1.5 μm . A transferable magnetic tape was then prepared by cutting the film onto which these layers had been applied, into a predetermined width.

a: protective layer composition

20	polyvinyl butyral resin	10 parts
	("S-LEC BM-1" manufactured by Sekisui Chemical Co. Ltd.)	
	MEK	35 parts
	toluene	35 parts
	ethyl alcohol	20 parts

25

b: printed layer, composition for forming the pattern printed

region

titanium oxide 20 parts

vinyl chloride-vinyl acetate copolymer resin 10 parts

("VAGH" manufactured by Union Carbide Ltd.)

5 MEK 35 parts

toluene 25 parts

ethyl acetate 10 parts

c: printed layer, composition for forming the filling layer

10 region

vinyl chloride-vinyl acetate copolymer resin 15 parts

("VAGH" manufactured by Union Carbide Ltd.)

MEK 35 parts

toluene 35 parts

15 ethyl acetate 15 parts

d: magnetic recording layer composition

barium ferrite magnetic powder 40 parts

(manufactured by Toda Kogyo Co. Ltd., coercivity 220 (kA/m))

20 vinyl chloride based resin 6 parts

("MR-110" manufactured by Nippon Zeon Co. Ltd.)

polyurethane resin 11 parts

("L7-750" manufactured by Dainippon Ink and Chemicals, Inc.)

MEK 18 parts

25 toluene 18 parts

cyclohexanone 7 parts

e: adhesive layer composition

	polyurethane resin	1.5 parts
	("TS-03" manufactured by Dainippon Ink and Chemicals, Inc)	
	vinyl chloride-vinyl acetate copolymer resin	3.5 parts
5	("1000LT3" manufactured by Denki Kagaku Consequently. Ltd.)	
	MEK	45 parts
	toluene	50 parts

Example 2

10 A transferable magnetic tape was produced in the same manner as that described for the example 1, with the exceptions that a composition f described below was used as the composition for forming the pattern printed region of the printed layer, and a composition g described below was used as
15 the composition for forming the filling layer region of the printed layer.

f: printed layer, composition for forming the pattern printed region

20	titanium oxide	15 parts
	phthalocyanine	5 parts
	vinyl chloride-vinyl acetate copolymer resin	10 parts
	("VAGH" manufactured by Union Carbide Ltd.)	
	MEK	35 parts
25	toluene	25 parts
	ethyl acetate	10 parts

g: printed layer, composition for forming the filling layer region

aluminum powder	20 parts
vinyl chloride-vinyl acetate copolymer resin	10 parts
5 ("VAGH" manufactured by Union Carbide Ltd.)	
MEK	35 parts
toluene	25 parts
ethyl acetate	10 parts

10 Comparative example 1

A transferable magnetic tape was produced in the same manner as that described for the example 1, with the exception that the printed layer of example 1 was formed using only the printing ink section corresponding with the pattern printed region, and the magnetic recording layer and the adhesive layer were then formed without providing the filling layer region (the printing ink section corresponding with the non-printed region).

20 Comparative example 2

A transferable magnetic tape was produced in the same manner as that described for the comparative example 1, with the exception that the thickness of the pattern printed region from the comparative example 1 was reduced to 0.5 μm .

25

Example 3

Using a polyethylene terephthalate film with a thickness

of 24 μm as a backing film, a composition a described above was applied to one side of the film using a reverse coating method to provide a protective layer which, following drying, had a thickness of 1 μm . Subsequently, using a composition b described above, a printing ink was applied by gravure printing in a pattern corresponding with the pattern of a printed layer, so that the thickness following drying was 1 μm (the pattern printed region (1)), and following drying, a gravure plate which is the negative pattern of the aforementioned pattern, was used to perform gravure printing with a composition g described above to produce a thickness after drying of 1 μm (the filling layer region (2)). Subsequently, a masking layer of the composition g described above was provided using a reverse coating method so that the thickness following drying was 2 μm , and a magnetic recording layer was then applied onto the masking layer using a composition d described above, using a reverse coating method, to produce a thickness following drying of 7 μm . Subsequently, a reverse coating method was used to provide an adhesive layer of a composition e described above, yielding a thickness following drying of 1.5 μm . A transferable magnetic tape was then prepared by cutting the film onto which these layers had been applied, into a predetermined width.

25 Comparative example 3

Using a polyethylene terephthalate film with a thickness

of 24 μm as a backing film, a composition a described above was applied to one side of the film using a reverse coating method to provide a protective layer which, following drying, had a thickness of 1 μm . Subsequently, using a composition b described above, a printing ink was applied by gravure printing in a pattern corresponding with the pattern of a printed layer, so that the thickness following drying was 1 μm (the pattern printed region (1)). Subsequently, a masking layer of the composition g described above was provided using a reverse coating method so that the thickness following drying was 2 μm , and a magnetic recording layer was then applied onto the masking layer using a composition d described above, using a reverse coating method, to produce a thickness following drying of 7 μm . Subsequently, a reverse coating method was used to provide an adhesive layer of a composition e described above, yielding a thickness following drying of 1.5 μm . A transferable magnetic tape was then prepared by cutting the film onto which these layers had been applied, into a predetermined width.

Comparative example 4

Using a polyethylene terephthalate film with a thickness of 24 μm as a backing film, a composition a described above was applied to one side of the film using a reverse coating method to provide a protective layer which, following drying,

had a thickness of 1 μm . Subsequently, using a composition b described above, a printing ink was applied by gravure printing in a pattern corresponding with the pattern of a printed layer, so that the thickness following drying was 1 μm (the pattern printed region (1)). Subsequently, a masking layer of the composition g described above was applied using an applicator coating method so that the wet surface was smooth and the thickness following drying was 1 μm , and a magnetic recording layer was then applied onto the masking layer using a composition d described above, using a reverse coating method, to produce a thickness following drying of 7 μm . Subsequently, a reverse coating method was used to provide an adhesive layer of a composition e described above, yielding a thickness following drying of 1.5 μm . A transferable magnetic tape was then prepared by cutting the film onto which these layers had been applied, into a predetermined width.

Comparative example 5

A transferable magnetic tape was produced in the same manner as that described for the comparative example 4, with the exception that the thickness of the masking layer from the comparative example 4 was increased to 2 μm .

Comparative example 6

A transferable magnetic tape was produced in the same

manner as that described for the comparative example 5, with the exception that the thickness of the masking layer from the comparative example 4 was increased to 5 μm .

5 Test items and results

Using the transferable magnetic tapes obtained in the examples 1 to 3 and the comparative examples 1 to 6, each of the layers was transferred onto a polyvinyl chloride card substrate using a card production machine (manufactured by Interline Ltd.), and in each case the backing film was then removed, and press working used to produce a magnetic card. The layer structure of a card type magnetic recording medium according to the examples of the present invention is shown in FIG. 4. Subsequently, the design capability of each card was evaluated by visual observation.

Furthermore, evaluation of the output variation of the magnetic cards was performed by carrying out recording and reading with a recording density of 200ftpi and a recording current value of I_{min} , and measuring the maximum output and the minimum output at that time as ratios (%) relative to the reference signal amplitude (U_R), and then determining the difference (R_1) and the standard deviation (D_1). Here, U_R is the maximum value of the read-back output when the recording current is changed and recording and reading is performed with a reference tape. Furthermore if the recording current which provides an output equivalent to 80% of the maximum value is termed I_R , then I_{min} is defined as the recording current which

generates 2.8 times the magnetic flux of the magnetic flux FR induced in the head by the recording current IR.

The same measurements were also performed (R2, D2) with a recording density of 500ftpi and a recording current value of Imax. Here, Imax is defined as the recording current which generates 3.5 times the magnetic flux of FR. When the values of R1, D1, R2 and D2 are large, the output variation is also large. Measurements were performed using a MAG-TESTER 2000 (manufactured by Barnes International Ltd.), and the measurements were conducted under the measurement conditions outlined in the ISO/IEC7811-6 standard. Furthermore, in the case of the occurrence of output variation corresponding with the printed layer, evaluation was conducted based on an output variation graph.

Next, evaluation of the resolution was conducted using the fraction $Ua3/Ua2$, produced by dividing the size of the average output ($Ua3$) when recording is performed with the recording current value at Imax and the recording density at 500ftpi, by the average output ($Ua2$) when recording is performed with the recording current value at Imax and the recording density at 200ftpi. The results are shown in Table 1.

Regarding the design capability of the magnetic cards, the example 1 and the comparative example 1, where the color of the magnetic recording layer was used as the background color and the color of the printing ink section was used to draw the pattern, were reasonably good. Furthermore, the

design capability of the example 2, where pigment was included in the printing ink section, was also good because the background was also colored, although the design capability of the example 3 and the comparative examples 3, 5, and 6, where
5 a masking layer is provided for masking the color of the magnetic recording layer, was best and displayed very distinct contrast. The design capability deteriorated somewhat in the comparative example 4 because the thickness of the masking layer was very thin, and in the comparative example 2, where
10 the thickness of the printing ink sections was very thin, the coloring of the pattern was poor and was also the most indistinct.

Regarding the output variation of the cards, in the examples 1, 2 and 3 where both a first region (the pattern printed region (1)) and a second region (the filling layer region (2)) were provided, output variation did not occur. In
15 contrast, in the comparative examples 1, 2 and 3 where no second region (filling layer region (2)) was provided, variation in the output was marked. Furthermore, regarding
20 the comparative examples 4, 5 and 6 where a leveling coating method was used during application of the masking layer so that the surface of the masking layer was smooth, output variation was marked in the comparative example 4 where the masking layer was very thin, but gradually improved in the
25 comparative examples 5 and 6 as the masking layer became thicker. However, compared to the examples 1, 2 and 3, the level of output variation was still high. Furthermore, in the

comparative example 6, because the thickness of the masking layer, at 5 μm , was very large, the level of the resolution reduced, and the magnetic recording and read-back characteristics worsened.

5

Table 1

	E-1	E-2	CE-1	CE-2	E-3	CE-3	CE-4	CE-5	CE-6
R1	7	8	14	12	8	17	18	15	17
D1	1.18	1.21	2.23	1.89	1.38	3.05	3.54	2.72	2.89
R2	8	8	13	10	8	15	17	15	16
D2	0.91	0.93	1.86	1.65	1.17	2.68	3.18	2.64	2.69
Design capability	C	B	C	D	A	B	C	B	A
Output variation	A	A	D	C	A	D	D	C	B
resolution (%)	94	94	94	94	93	93	94	92	87

Note: E-1 refers to the example 1, CE-1 to the comparative example 1. The other examples are abbreviated in a similar manner.

10

Design capability

A: The contrast and coloring are good, and the design capability is extremely high.

15

B: The contrast is good and the design capability is high. The coloring has deteriorated somewhat.

C: The contrast and coloring have both deteriorated somewhat, but the design capability is high.

D: The coloring is poor and the design capability is

low.

Output variation

- A: No variation observed in the output corresponding
5 with the printed layer.
- B: A little variation occurs in the output
corresponding with the printed layer.
- C: Variation occurs in the output corresponding with
the printed layer.
- 10 D: Marked variation occurs in the output corresponding
with the printed layer.

INDUSTRIAL APPLICABILITY

In a magnetic card in which a printed layer is provided
15 on the magnetic stripe in order to improve the ability to
incorporate designs on the card, by providing the magnetic
recording layer so that the thickness thereof is uniform and
so that there are no differences in level in the boundary
surface of the magnetic recording layer closer to the pattern
20 printed region, a magnetic card can be produced which has both
good magnetic recording characteristics and good design
capability and for which output variation does not occur.
Furthermore, when the card is undergoing the transfer process
and being manufactured, then for the transferable magnetic
25 tape which provides the printed layer, by using a transferable
magnetic tape where the magnetic recording layer is formed so
that the thickness is uniform and so that there are no

differences in level in the boundary surface of the magnetic recording layer closer to the pattern printed region, the superior card described above can be achieved easily.

CLAIMS

1. (Amended) A transferable magnetic tape in which a printed layer, a magnetic recording layer, and an adhesive layer are layered in sequence upon a backing film with said printed layer closest to said backing film, wherein said printed layer comprises:

- (1) a pattern printed region and,
- (2) a filling layer region outside said pattern printed region

(1),

and moreover

- (3) a thickness of said printed layer is uniform, and
- in said transferable magnetic tape a coercivity of magnetic powder contained in said magnetic recording layer is 20 to 320 kA/m.

2. (Amended) A transferable magnetic tape according to claim 1, wherein said pattern printed region and said filling layer each comprise a printing ink.

3. (Amended) A transferable magnetic tape according to either one of claim 1 and claim 2, wherein a resin layer having peelability is provided between said backing film and said printed layer.

4. A transferable magnetic tape according to either one of claim 1 and claim 2, wherein a masking layer is provided

between said printed layer and said magnetic recording layer.

5. (Amended) A transferable magnetic tape according to either one of claim 1 and claim 2, wherein a resin layer
5 having peelability is provided between said backing film and said printed layer, and a masking layer is provided between said printed layer and said magnetic recording layer.

6. (Amended) A method of manufacturing a transferable
10 magnetic tape, wherein a printed layer comprising a pattern printed region and a filling layer region is formed on a backing film by a printing method, and a magnetic recording layer containing magnetic powder with a coercivity of 20 to 320 kA/m, and an adhesive layer are then sequentially layered
15 thereon by a coating method.

7. (Amended) A method of manufacturing a transferable magnetic tape according to claim 6, wherein said pattern printed region and said filling layer are formed using
20 printing inks with volumetric shrinkage rates which accompany drying and solidification equivalent.

8. (Amended) A method of manufacturing a transferable magnetic tape according to either one of claim 6 and claim 7,
25 wherein a printed layer is formed after a resin layer having peelability is formed upon said backing film.

9. (Amended) A method of manufacturing a transferable magnetic tape according to either one of claim 6 and claim 7, wherein a masking layer is provided between said printed layer and said magnetic recording layer.

5

10. (Amended) A method of manufacturing a transferable magnetic tape according to either one of claim 6 and claim 7, wherein a resin layer having peelability is provided between said backing film and said printed layer, and a masking layer is provided between said printed layer and said magnetic recording layer.

10

11. (Amended) A method of manufacturing a transferable magnetic tape according to any one of claim 6, claim 7, claim 8, claim 9 and claim 10, wherein after said pattern printed region is formed using a printing cylinder corresponding therewith, said filling layer is formed in said filling layer region using a printing cylinder corresponding therewith, without gaps between said pattern printed region, and without overlapping.

15

20

12. (Amended) A magnetic card in which a magnetic recording layer and a printed layer are formed in sequence on a card base material with said magnetic recording layer closer to said base material, wherein said printed layer comprises:

25

- (1) a pattern printed region and,
- (2) a filling layer region outside said pattern printed region

(1),

and moreover

(3) a thickness of said printed layer is uniform, and
in said magnetic card a coercivity of magnetic powder

5 contained in said magnetic recording layer is 20 to 320 kA/m.

13. A magnetic card according to claim 12, having an adhesive
layer on said card base material.

10 14. A magnetic card according to claim 12, further having a
protective layer on said printed layer.

15 15. A magnetic card according to claim 12, further having a
masking layer between said printed layer and said magnetic
recording layer.

16. (Amended) A magnetic card according to claim 12, having a
protective layer on said printed layer and a masking layer
between said printed layer and said magnetic recording layer.

ABSTRACT

A magnetic card is provided in which output variation does not occur even when a printed layer is provided on the magnetic recording layer, and a transferable magnetic tape and method of manufacturing the same is provided such that when the transferable magnetic tape is converted into a card, design can be incorporated on the magnetic stripe without output variation occurring. In a magnetic card in which a magnetic recording layer and a printed layer are formed in sequence on a card base material with the magnetic recording layer closer to the base material, the printed layer comprises a pattern printed region and a region consisting of a filling layer outside the pattern printed region, and moreover the thickness of the printed layer is substantially uniform. In a transferable magnetic tape in which a printed layer, a magnetic recording layer, and an adhesive layer are layered in sequence upon a backing film with the printed layer closest to the backing film, the printed layer comprises a pattern printed region and a region consisting of a filling layer outside the pattern printed region, and moreover the thickness of the printed layer is substantially uniform. In a method of manufacturing a transferable magnetic tape, a pattern printed region is formed on a backing film, a filling layer is subsequently formed in a non-printed region and a printed layer comprising the printed region and the non-printed region is formed so as to have a uniform thickness, and a magnetic recording layer and an adhesive layer are then sequentially layered thereon.

Fig. 1

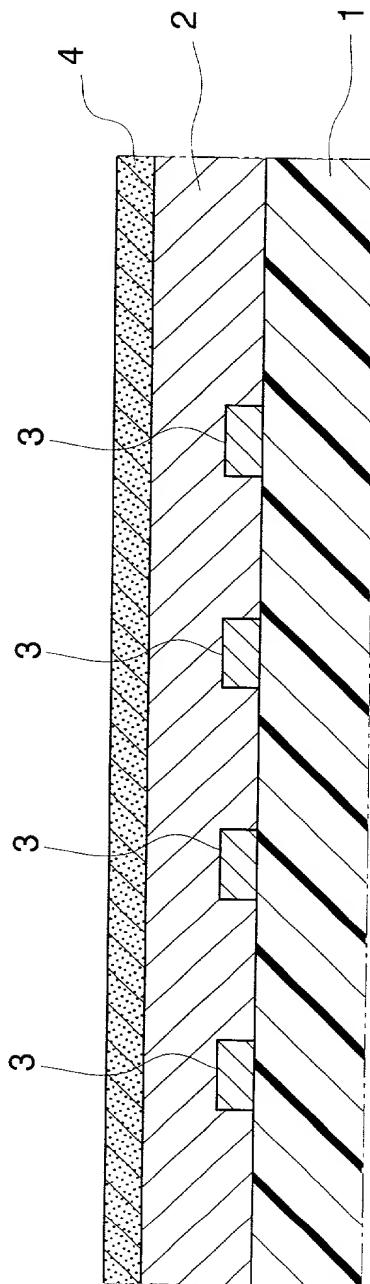


Fig. 2

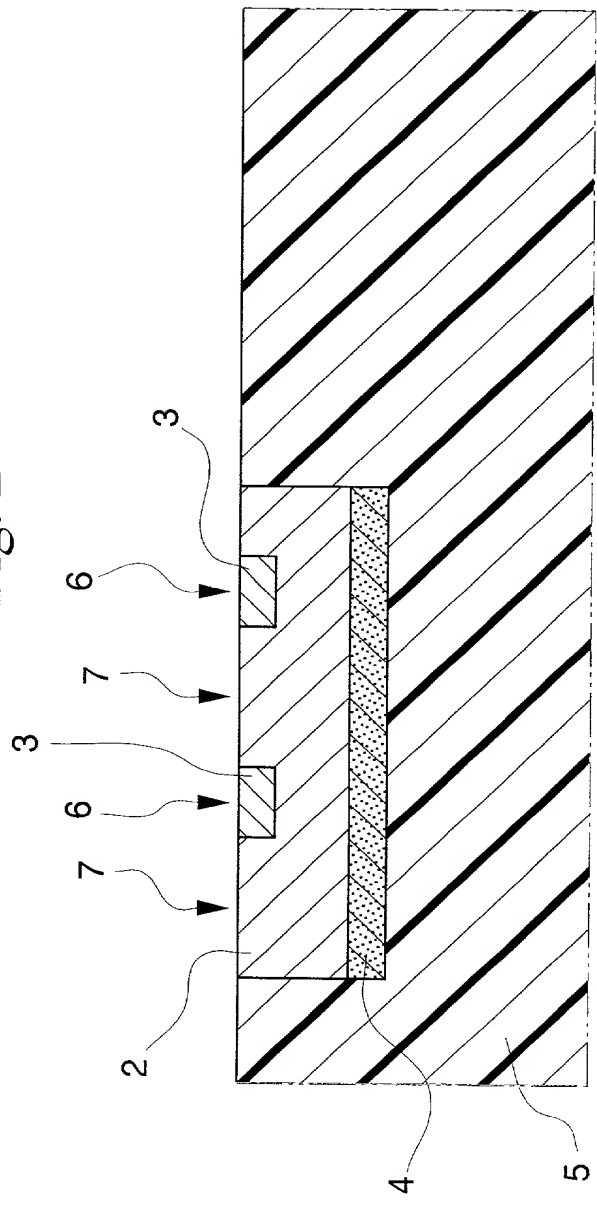


Fig. 3

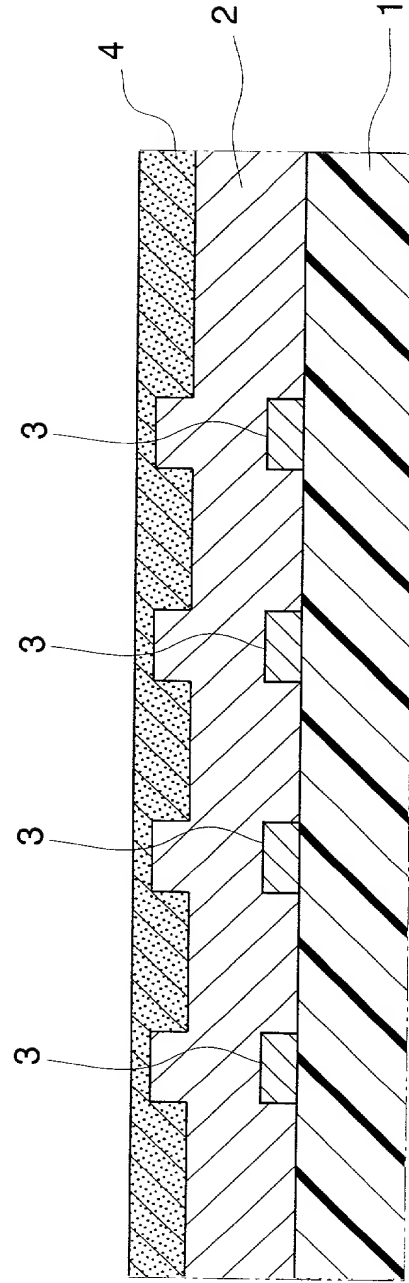
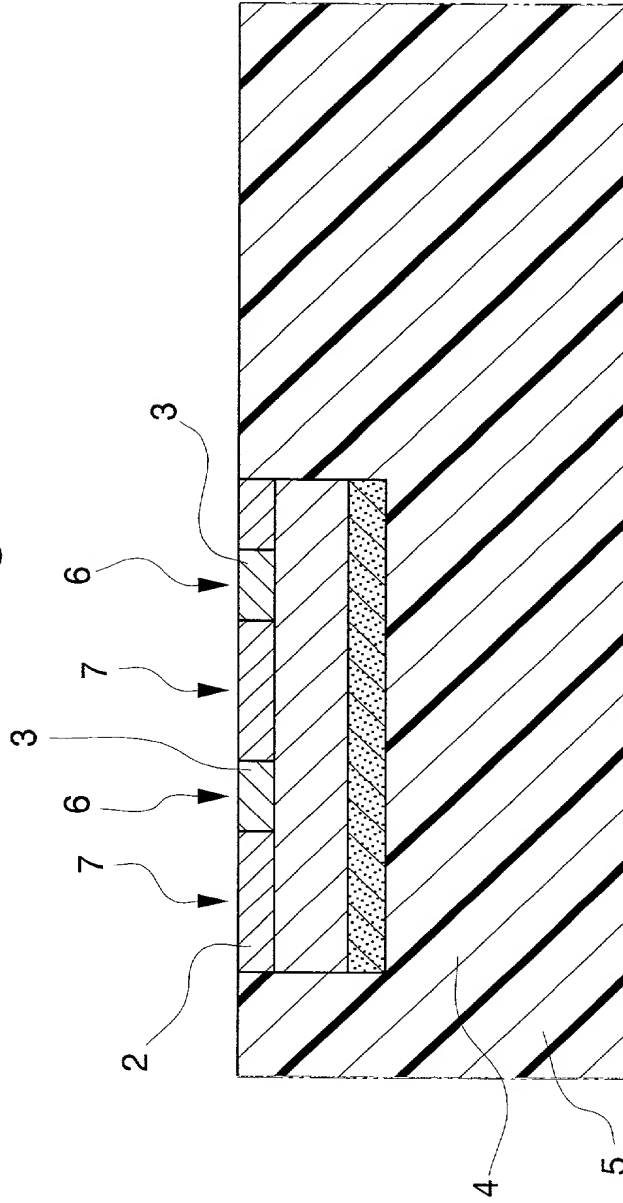


Fig. 4



Declaration For U.S. Patent Application

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled
(Insert Title) TRANSFERABLE MAGNETIC TAPE, METHOD OF MANUFACTURING SAME, AND MAGNETIC CARD

the specification of which

(Check one of blocks 1, 2, or 3. See note A on back of this page)

1. ☐ is attached hereto.
2. ☒ was filed on September 14, 1999 as
International PCT Application Serial No. PCT/JP99/05001
and was amended on _____
(if applicable)
3. ☐ was filed on _____ as
U.S. Application Serial No. _____
and was amended on _____
(if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application as defined in Title 37, Code of Federal Regulations, § 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application for which priority is claimed:

(List prior foreign applications. See note B on back of this page)	Patent <u>10-259964</u> (Number)	Japan (Country)	<u>14/09/1998</u> (Day/Month/Year Filed)	Priority Claimed <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
	_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	<input type="checkbox"/> Yes <input type="checkbox"/> No
	_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	<input type="checkbox"/> Yes <input type="checkbox"/> No
	_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	<input type="checkbox"/> Yes <input type="checkbox"/> No

(See note C on back of this page)

☐ See attached list for additional prior foreign applications

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

(List Prior U.S. Applications)	(Application Serial Number)	(Filing Date)	(Status) (patented, pending, abandoned)
	_____ (Application Serial Number)	_____ (Filing Date)	_____ (Status) (patented, pending, abandoned)

And I hereby appoint as principal Attorneys James E. Armstrong, III, Reg. No. 18,366; William F. Westerman, Reg. No. 29,988; Ken-Ichi Hattori, Reg. No. 32,861; John R. Pegan, Reg. No. 18,069; William G. Kratz, Jr., Reg. No. 22,631; Le-Nhung McLeland, Reg. No. 31,541; James P. Welch, Reg. No. 17,379; Ronald F. Naughton, Reg. No. 24,616; Albert Tockman, Reg. No. 19,722; J. Herbert O'Toole, Reg. No. 31,404; Mel R. Quintos, Reg. No. 31,898; Michael J. Foycik, Jr., Reg. No. 30,928; Mary E. Gormley, Reg. No. 34,409; James C. Lydon, Reg. No. 30,082; Vivian P. Kafalenos, Reg. No. 32,903; Donald W. Hanson, Reg. No. 27,133; Stephen G. Adrian, Reg. No. 32,878; Gregory R. Muir, Reg. No. 35,293; William L. Brooks, Reg. No. 34,129; Joseph J. Zito, Reg. No. 32,076; Stephen B. Parker, Reg. No. P-36,631.

Please direct all communications to the following address:

**ARMSTRONG, WESTERMAN, HATTORI,
McLELAND & NAUGHTON**
1725 K Street, N.W., Suite 1000
Washington, D.C. 20006
(202) 659-2930 Fax: (202) 887-0357

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Title 18, the United States Code, § 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

(See note D on back of this page)

Full name of sole or first inventor Daisuke Yano

Inventor's signature D. Yano March 5, 2001

Residence Kasukabe-shi, Japan JPX Date

Citizenship Japan

Post Office Address 1546-3-202, Ooaza Ushijima, Kasukabe-shi, Saitama-ken, Japan

200 Full name of second joint inventor, if any Yoshikazu Yamazaki

Inventor's signature Y. Yamazaki March 5, 2001

Residence Kounosu-shi, Japan JPX Date

Citizenship Japan

Post Office Address 1177-10, Kounosu, Kounosu-shi, Saitama-ken, Japan

300 Full name of third joint inventor, if any Tessyu Miyahara

Inventor's signature T. Miyahara March 5, 2001

Residence Ageo-shi, Japan JPX Date

Citizenship Japan

Post Office Address 4-12-8-206, Midorigaoka, Ageo-shi, Saitama-ken, Japan

Full name of fourth joint inventor, if any _____

Inventor's signature _____

Residence _____ Date

Citizenship _____

Post Office Address _____

Full name of fifth joint inventor, if any _____

Inventor's signature _____

Residence _____ Date

Citizenship _____

Post Office Address _____

Full name of sixth joint inventor, if any _____

Inventor's signature _____

Residence _____ Date

Citizenship _____

Post Office Address _____

Full name of seventh joint inventor, if any _____

Inventor's signature _____

Residence _____ Date

Citizenship _____

Post Office Address _____

Full name of eighth joint inventor, if any _____

Inventor's signature _____

Residence _____ Date

Citizenship _____

Post Office Address _____